

Section II. REMARKS

The pending claims in the application are 1-7, 9-26 and 33-39.

Submission of Supplemental Information Disclosure

In compliance with the ongoing duty of disclosure imposed by 37 C.F.R. §1.56, applicants submit herewith a Supplemental Information Disclosure Statement and PTO Form 1449.

Amendment of Claims 1 and 16 and Addition of New Claims 33-39

Claim 1 has been amended herein to include the limitations of original claim 8. Claim 16 has been amended correspondingly to claim 1.

Claims 5, 6, 9-12, 23 and 24 were objected to as being dependent upon a rejected base claim, but the Examiner stated in the October 28, 2003 Office Action that these claims would be found allowable if rewritten in independent form including all of the limitations of the original base claim and any intervening claims.

Accordingly, applicants have rewritten claims 5, 9, 11 and 23 in independent form, as new claims 33-36, respectively. Withdrawal of the claim objections is therefore respectfully requested.

New claims 37-39 have been added herein.

Support for claims 37-38, which recite the utilization of an iridium (I)-containing precursor, can be found in the instant specification at page 12, lines 11-16 through page 14, lines 1-2.

Support for claim 39, which recites a method of forming an elemental iridium film on a substrate wherein the iridium is deposited in an oxidizing ambient environment, can be found in the instant specification at page 5, lines 4-11.

Rejection of Claims and Traversal Thereof

In the October 28, 2003 Office Action:

claims 1-4, 7, 8, 13-22, 25 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kirlin et al. (U.S. Patent No. 5,840,897), Vaartstra (U.S. Patent No. 5,763,633) or Baum et al. (U.S. Patent No. 5,096,737).

This rejection is hereby traversed in application to pending claims 1-7, 9-26 and 33-39, as amended herein. The various grounds of rejection are addressed in turn below.

Rejection under 35 U.S.C. §103(a)

In the October 28, 2003 Office Action, claims 1-4, 7, 8, 13-22, 25 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kirlin et al. (U.S. Patent No. 5,840,897) (hereinafter Kirlin '897), Vaartstra (U.S. Patent No. 5,763,633) or Baum et al. (U.S. Patent No. 5,096,737) (hereinafter Baum '737). The Examiner rejected applicants' claims disjunctively, therefore each reference will be individually addressed hereinbelow.

§103(a) Rejection Based on Kirlin '897

In the October 28, 2003 Office Action, claims 1-4, 7, 8, 13-22, 25 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kirlin et al. (U.S. Patent No. 5,840,897) (hereinafter Kirlin '897). Applicants traverse such rejection.

According to the Examiner:

“Kirlin ['897] . . . teach[es] composition [sic] including metal complex source reagents having ligand complexes for manufacturing iridium coatings for producing microelectronic devices such as DRAM or FRAM capacitors. A chemical vapor deposition process is utilized in an oxygen atmosphere and the metal complex is decomposed to form the metal coating.” (emphasis added)

Applicants vigorously disagree and submit that the Examiner has failed to establish a *prima facie* case of obviousness.

Kirlin '897 relates to thermally decomposable organometallic compounds and complexes useful for the formation of metal and metal oxide films on substrates using CVD processes.

Considering Kirlin '897 as a whole, as the Examiner must do,¹ Kirlin '897 does not teach or suggest every limitation of applicants' claimed invention, including depositing a Group VIIIB metal, such as iridium, on a substrate in an oxidizing ambient environment.

For example, referring to the periodic table recreated hereinbelow, which is representative of the transition metal region, Kirlin '897 is completely lacking any disclosure relating to the deposition of the Group VIIIB metals, including iridium. For ease of reference, the deposition of the transition elements shaded in grey are disclosed in Kirlin '897,² and are shown in the table below with a representative Kirlin '897 example number.

IIIB	IVB	VB	VIB	VIIIB	← VIIIB →			IB	IIB
Sc	Ti Ex. 7	V	Cr	Mn Ex. 9	Fe	Co	Ni	Cu Ex. 26	Zn
Y Ex. 16	Zr Ex. 10	Nb Ex. 5	Mo Ex. 46	Tc	Ru	Rh	Pd	Ag	Cd
La Ex. 9	Hf	Ta Ex. 6	W	Re	Os	Ir	Pt	Au	Hg

Notably, the Group IB-VIIIB metal compounds have fundamentally different chemical and physical properties from the Group VIIIB metal compounds. For example, the Group VIIIB elements in the fifth and sixth period, e.g., Ru, Rh, Pd, Os, Ir and Pt, are commonly referred to as the “noble metals”³ because of their renowned inertness. Given this inertness, the physical and chemical conditions necessary to deposit noble metal-containing films will vary substantially from those conditions necessary to deposit other, more reactive, transition metal-containing films.

As such, one skilled in the art of chemical deposition would not in any logical manner look to the Kirlin '897 teaching of Group IB-VIIIB metal compound deposition for guidance in depositing Group VIIIB metal compounds. Specifically, the process conditions required for the deposition of Group IB-VIIIB metal compounds does NOT extrapolate to the process conditions required for the deposition of Group VIIIB metal compounds.

¹ See, *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 220 U.S.P.Q. 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).

² Notably, Kirlin '897 also discloses the deposition of many representative elements, including Mg, Ca, Sr, Ba, Al, Ga, Pb and Bi.

³ also commonly referred to as the platinum group metals.

Manifestly, Kirlin `897 fails to provide any disclosure relating to the deposition of the Group VIIIB metal compounds, including iridium-containing compounds.

Since there is no motivation, teaching or suggestion to modify Kirlin `897 and since the recited features of applicants' claimed invention are not in any way disclosed or suggested in the Kirlin `897 reference, applicants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness.

Accordingly, applicants respectfully request withdrawal of the rejection of claims 1-4, 7, 8, 13-22, 25 and 26 under 35 U.S.C. §103(a) over Kirlin `897.

§103(a) Rejection Based on Vaartstra

In the October 28, 2003 Office Action, claims 1-4, 7, 8, 13-22, 25 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Vaartstra (U.S. Patent No. 5,763,633). Applicants traverse such rejection.

According to the Examiner:

“Vaartstra . . . teach[es] composition [sic] including metal complex source reagents having ligand complexes for manufacturing iridium coatings for producing microelectronic devices such as DRAM or FRAM capacitors. A chemical vapor deposition process is utilized in an oxygen atmosphere and the metal complex is decomposed to form the metal coating.” (emphasis added)

Applicants vigorously disagree.

Vaartstra relates to a method of forming a metal-containing film, e.g., metal, metal oxide, or metal nitride, from iridium carboxylate complexes using a **non-volatile deposition technique including spraying, spin-on, and dip coating.** The iridium carboxylate complexes are formulated to ensure that they do not vaporize from the surface prior to thermal decomposition to form the metal-containing film (see Vaartstra, col. 3, lines 38-47).

Vaartstra fails to teach or suggest all of the limitations of applicants' amended claim 1, which recites:

“[a] method of forming an iridium-containing film on a substrate, from an iridium-containing precursor thereof that is decomposable

to deposit iridium on the substrate, said method comprising decomposing the precursor and depositing iridium on the substrate in an oxidizing ambient environment, wherein the decomposition of the precursor and deposition of iridium on the substrate is carried out by a process selected from the group consisting of chemical vapor deposition (CVD), assisted-CVD, ion plating, rapid thermal processing, and molecular beam epitaxy.” (emphasis added)

Importantly, Vaartstra teaches away from going in the direction of applicants’ claimed invention. Specifically, Vaartstra states:

“[t]hese complexes are particularly advantageous for the deposition of . . . metal-containing films, using film-casting techniques such as spin-on technology or MOD (i.e., metalorganic deposition) technology because they do not vaporize from the surface before thermal decomposition to form the metal-containing film. This is due to the relatively high intermolecular forces and high molecular weight of the carboxylate ligands. Thus, the complexes of the present invention are typically not suitable for chemical vapor deposition.” (see Vaartstra, col. 3, lines 38-47) (emphasis added)

As such, one skilled in the art reading the Vaartstra reference would not be motivated to go in the direction of applicants’ claimed invention, e.g., depositing the iridium-containing films using CVD and other volatile component deposition techniques.

The foregoing remarks directed to claim 1, and claims 2-4, 7, 8 and 13-15 dependent thereunder, are equally applicable to claim 16, amended in a manner analogous to claim 1, and claims 17-22, 25 and 26 dependent thereunder.

Because Vaartstra fails to disclose or provide any derivative basis for applicants’ claimed invention, the Examiner is respectfully requested to withdraw the rejection of claims 1-4, 7, 8, 13-22, 25 and 26 under 35 U.S.C. §103(a) based on Vaartstra.

§103(a) Rejection Based on Baum `737

In the October 28, 2003 Office Action, claims 1-4, 7, 8, 13-22, 25 and 26 were rejected under 35 U.S.C. §103(a) as being unpatentable over Baum `737.

According to the Examiner:

“Baum [‘737] . . . teach[es] composition [sic] including metal complex source reagents having ligand complexes for manufacturing iridium coatings for producing microelectronic devices such as DRAM or FRAM capacitors. A chemical vapor deposition process is utilized in an oxygen atmosphere and the metal complex is decomposed to form the metal coating.” (emphasis added)

Applicants vigorously disagree and submit that the Examiner has failed to establish a *prima facie* case of obviousness.

Baum ‘737 relates to the chemical vapor deposition of high purity iridium metal from iridium beta-diketone precursors.

However, contrary to the Examiner’s contention, Baum ‘737 does NOT teach a chemical vapor deposition process “in an oxygen atmosphere.” The deposition process conditions disclosed in Baum ‘737 (in the Background Art and Examples 3-6) are summarized hereinbelow for ease of reference:

- Background Art: Deposition of Cu, Ni, Co and Pb films. Carrier/reducing gas is H₂, hydrazine, and CO (see Baum ‘737, col. 1, lines 43-49);
- Background Art: Deposition of Cu films. Reducing gas is hydrogen (see Baum ‘737, col. 1, lines 50-54);
- Background Art: Deposition of Cu films. Reducing gas is hydrogen (see Baum ‘737, col. 1, lines 60-65);
- Example 3: Deposition of Ag films. Carrier gas is hydrogen or helium (see Baum ‘737, col. 5, line 31);
- Example 4: Deposition of Rh films. Carrier gas is hydrogen or helium (see Baum ‘737, col. 5, lines 43-44);
- Example 5: Deposition of (COD)Cu(I)(hfacac). An ambiguous “carrier gas” is used (see Baum ‘737, col. 5, lines 56, 59 and 65); and
- Example 6: Deposition of (DMCOD)Cu(I)(hfacac). “Carrier gas” is disclosed as being hydrogen or helium (see Baum ‘737, col. 6, line 30).

Clearly, Baum ‘737 only teaches or suggests deposition of metals in reducing environments, e.g., hydrogen, or inert environments, e.g., helium. Accordingly, Baum ‘737 fails to teach or suggest all of the

limitations of applicants' claimed invention, wherein the iridium-containing film is deposited on a substrate in an oxidizing ambient environment.

Further, there is no motivation or suggestion in Baum `737 to deposit the iridium-containing films in an oxidizing environment.

The Examiner is respectfully reminded that the mere fact that a reference can be modified does not render the resultant modification obvious unless the prior art also suggests the desirability of the modification. *In re Mills*, 16 U.S.P.Q.2d 1430 (Fed. Cir. 1990). Not only must the Examiner's rejection be specific as to how one of ordinary skill in the art would have found it obvious to modify the reference, the Examiner must explain with specificity what areas of the reference suggest the modification. See, e.g., *Ex parte Humphreys*, 24 U.S.P.Q.2d 1255, 1262 (B.P.A.I. 1992).

Since there is no motivation, suggestion or teaching to modify Baum `737, and since the recited features of applicants' claimed invention are not in any way disclosed or suggested in the Baum `737 reference, applicants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness.

Accordingly, applicants respectfully request withdrawal of the rejection of claims 1-4, 7, 8, 13-22, 25 and 26 under 35 U.S.C. §103(a) over Baum `737.

Fees Payable for Added Claims 33-39 and Supplemental IDS

Seven (7) independent claims have been added herein. Applicants have exceeded the number of independent claims for which payment was originally made, by six (6). Accordingly, an added claims fee of $(6 \times \$86.00) + (7 \times \$18.00) = \$642.00$ is due.

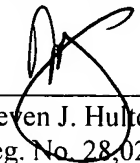
In addition, an added fee of \$180.00 is due under 37 C.F.R. §1.17(p) for the Supplemental IDS submitted herein.

The total fee of \$822.00 is authorized to be charged in the attached credit card authorization form. Authorization also is hereby given to charge any deficiency in applicable fees for this response to Deposit Account Number 08-3284 of Intellectual Property/Technology Law.

CONCLUSION

Based on the amendments made herein and the foregoing remarks, claims 1-7, 9-26 and 33-39 are now in form and condition for allowance. The Examiner therefore is respectfully requested to reconsider and allow such amended claims.

Respectfully submitted,



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